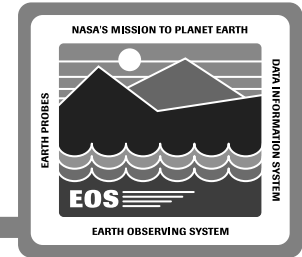


Off-Line Analysis Scenario

Nelson V. Pingitore

18 October 1995

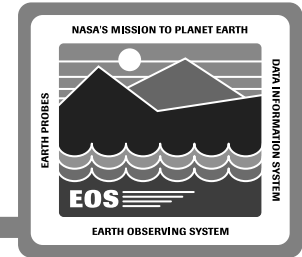
Offline Analysis Description



Description:

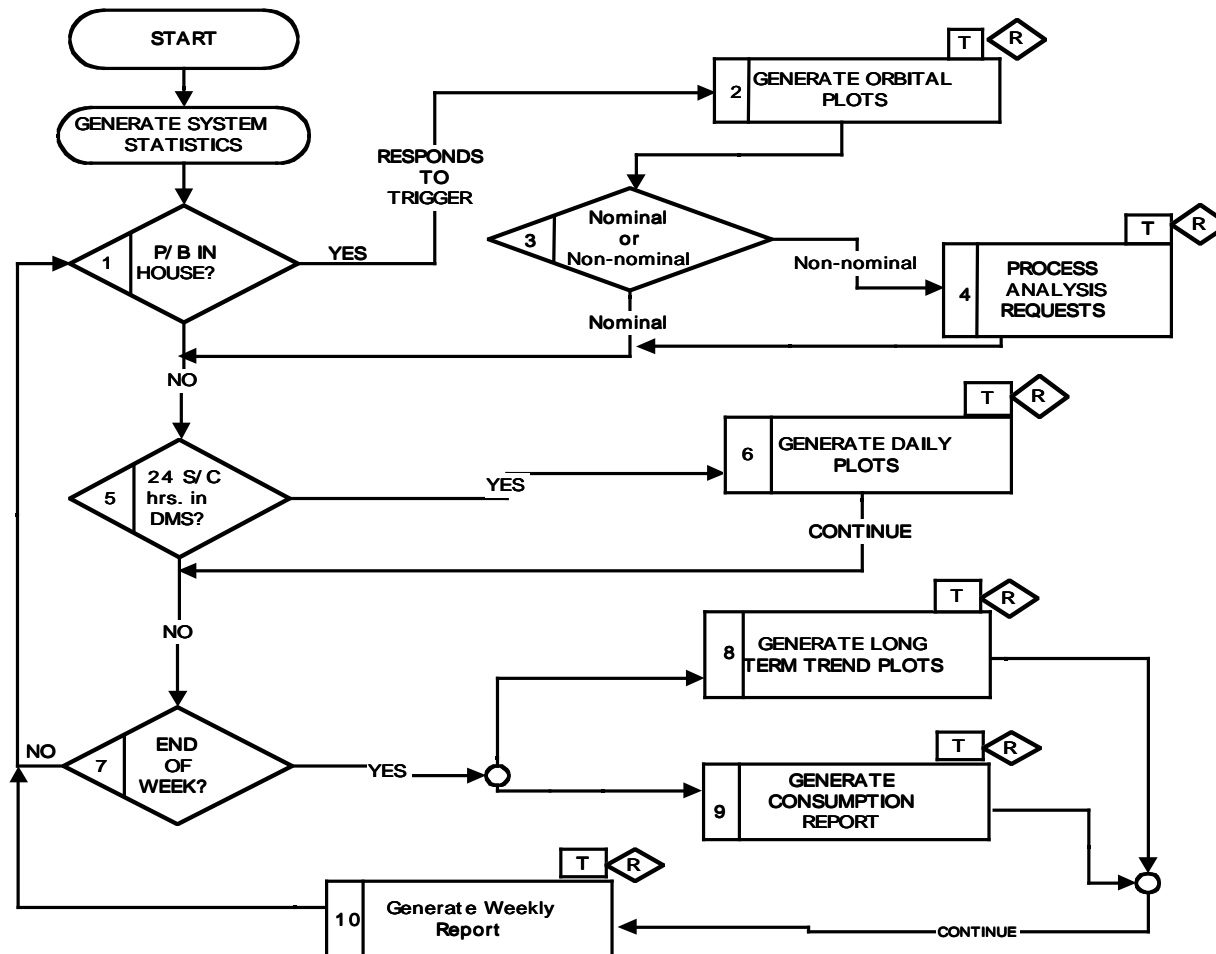
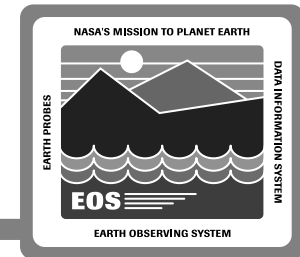
- **Offline Analysis is composed of:**
 - **Short Term subsystem and component performance analysis**
 - **Long Term subsystem and component trend analysis**
 - **Extensive graphing of:**
 - telemetry(spacecraft and instruments)**
 - derived telemetry(pseudo-telemetry)**
 - ground telemetry(ODMs, CODAs, FDF predicts)**
 - **24 hours of telemetry reviewed each day**
 - **Long term trends review daily and weekly**
 - **A comprehensive weekly status report for mission history and customer information**

Offline Analysis: Use / How Often

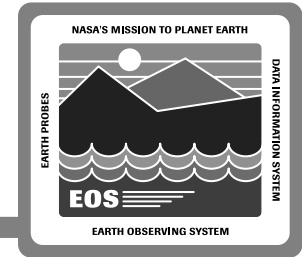


- The FOT maintains AM-1 Health and Safety through rigorous Telemetry Analysis practices
- Offline Telemetry Analysis is performed jointly by the on-line and off-line staff
- Data Reduction techniques applied to AM-1 and ground telemetry to reduce Analysis complexity include:
 - Sampling telemetry every nth occurrence
 - Statistics
 - Predicted vs. Actual Delta Algorithms
 - User Defined Algorithms
 - Orbital Graphs, Daily Graphs, Trend Graphs

Offline Analysis Flow Chart



System Statistics



- The Analysis System automatically executes statistical processing on:
 - All H/K tlm
 - Database derived tlm
 - Selected FDF data

Processing intervals:

Orbit

Orbit day

Orbit night

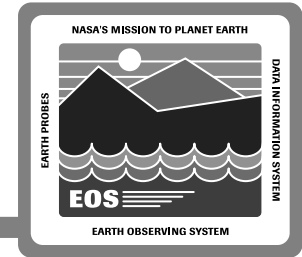
Daily

Monthly

Mission-to-date

- Data available to FOT for graphing, tabulation, carry-out, or inclusion into reports

Short Term Performance Analysis



Step 1

- FOT identifies a set of telemetry parameters that represents a high level status of AM-1 health for routine graphing
- FOT identifies a set of ground telemetry parameters for routine graphing along with the AM-1 parameters
- The FOT uses the *Analysis Request* windows to prepare and submit Analysis requests

- User inputs:

Requests, Time Span of Request, Standing Order

Telemetry Parameters(AM-1, Ground)

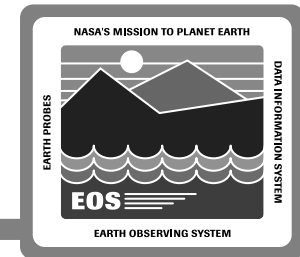
Associated sampling rates and statistics options

User Algorithms

Product Outputs

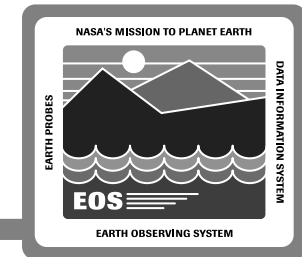
Graph, Table, Info Window, Carry Out

Analysis Request Window



Analysis Request			
File		Help	
Request Name <input type="text" value="MyRequest"/>		Request Status: New Request	
Selected Times		Selected Telemetry	
Start Time	Stop Time	Telemetry Point	Sampling Rate Statistics
95/0407:11:38	95/047 07:11:38	ACRCMD	All Data 60 secs
		MITECATT	Changes Only Daily
		MITECATT	Every 5th Off
<input type="button" value="Select Time"/>		<input type="button" value="Select TLM"/>	
Product Views			
<input type="checkbox"/> Info	<input type="button" value="Format"/>	<input type="checkbox"/> Graph	<input type="button" value="Format"/>
<input type="checkbox"/> Table	<input type="button" value="Format"/>	<input type="checkbox"/> CarryOut File	
<input type="button" value="OK"/>	<input type="button" value="Generate Report"/>	<input type="button" value="Cancel"/>	<input type="button" value="Help"/>

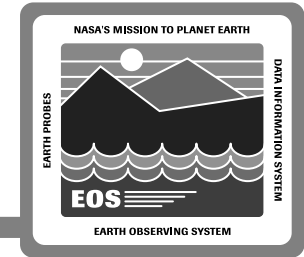
Analysis Status Window



Analysis Request Status						Last Refresh time 12:13:45
Request Name	Status	Priority	Processing Start Time	Percent Completed	User ID	
DiagBattery	Processing		12:30:14	45	Mquick	<div>▲</div> <div></div> <div>▼</div>
TrenCheck	Processing		12:40:20	90	Mquick	
QualityStats	Pending	10			Mquick	
InstrumentDiags	Complete				Mquick	
ResourceSummary	Processing	5	10:30:15	80	Mquick	
PowerSupply	Processing	1	12:11:35	60	Mquick	
SSRStats	Complete				Mquick	
Routine3/26/95	Complete				Mquick	
LimitChk	Pending	6			Mquick	
ErrorReport	Pending	7			Mquick	

☐ Prioritize
 PRI #
☐ Delete
 ☐ Select Output

Short Term Analysis Graphs



Step 2

- SSR playback received and merged into the archive
- Trigger initiates an Analysis Request
- Request Status available through the Status display

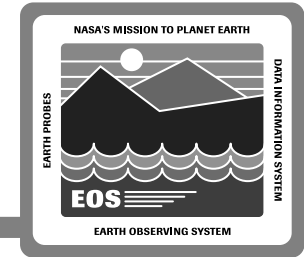
Step 3

- FOT Engineers review graphs for nominal vs. non-nominal performance
 - Dataset Overlay capability allows comparison of past behavior with current behavior

Step 4

- Non-nominal performance warrants immediate contact of the responsible subsystem engineer
- Additional high resolution graphs of the parameters of interest

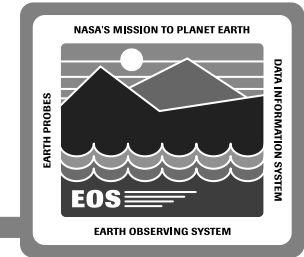
Daily Performance Analysis



Step 5

- The FOT identifies a set of telemetry parameters that represents a comprehensive status of AM-1 health for daily graphing
- The FOT identifies a set of ground telemetry parameters for daily graphing
- The FOT formulates Analysis Request via the *Analysis Request Window*
- Daily requests are submitted as standing orders to execute at the end of each day

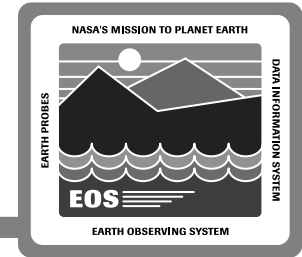
Daily Performance Analysis Graphs



Step 6

- FOT staff inspects / examines graphs for non-nominal performance
- Anomalous parameters are re-graphed at a higher resolution
- Data is examined for correlation of anomalous behavior with subsystem operations schedule

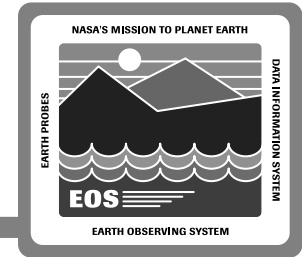
Weekly Analysis



Step 7

- **System Statistics are available for Trend Graphing**
- **The FOT Engineers identify telemetry parameters that represent a comprehensive status of AM-1 health for routine trend graphing**
- **The FOT Engineers identify ground telemetry parameters for routine trend graphing**
- **Resultant Analysis Request executed as a standing order to graph at the end of each week**
- **The subsystem engineers are looking for seasonal trends in component behavior or cycle day trends in component behavior**

Weekly Analysis Products



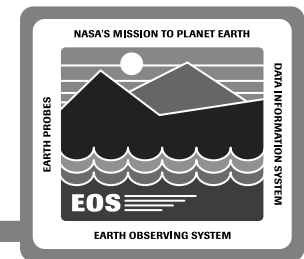
Step 8

- Trend graphs are generated for inspection by the Engineering staff
- Trends in subsystem performance are characterized as nominal or non-nominal

Step 9

- A report is generated that contains the usage of AM-1 consumables, for inspection by the Engineering staff
 - Analysis computes the total elapsed time in each state, and the total number of state changes, on a Daily, Monthly, and Mission To Date interval
 - This report is available via the *On Demand Report* tool

On Demand Report Display



AM1 Parameter Out-Of-Limits Report

Report Name: Start Time:

Author's Name: Stop Time:

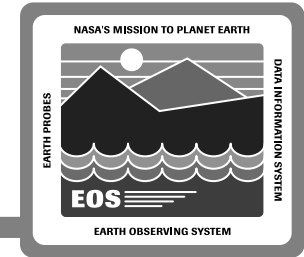
Report Output Options: ☐ Browser ☐ Printer ☐ File

Subsystem	Find <input type="text"/>	Selected
<input type="checkbox"/> AM1-ASTER	MICAMERA	MICPSDAI
<input type="checkbox"/> AM1-CERES-Aft	MICOVER	MICPSDFI
<input type="checkbox"/> AM1-CERES-Fore	MINCALPN	MICPSONI
<input type="checkbox"/> AM1-MISR	MISCALPN	
<input type="checkbox"/> AM1-MODIS	MIPROC	
<input type="checkbox"/> AM1-MOPITT	MIGONIO	
<input type="checkbox"/> AM1-S/C Bus	MICPSAAI	
	MICPSAFI	
	MICPSANI	
	MISPSBAAI	
	MICPSBFI	
	MICPSBNI	

Filter All All -> -> <- <- All

OK Apply Standing Order Cancel Help

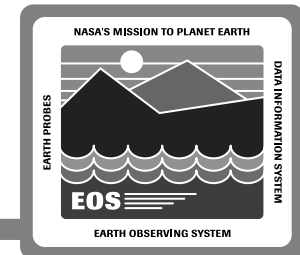
Weekly Reports



Step 10

- **The Offline Engineer staff prepares a weekly report that contains:**
 - **Summary of the week's events**
 - **Anomaly notification**
 - **Scheduled or ongoing tests**
 - **Test results of concluded tests**
 - **Subsystem statuses**
 - **Trend plots**
 - **Ground track status**
 - **Resource Consumption**
 - **etc.**

Custom Report Display



Custom Report

Report Name: Start Time:

Author's Name: Stop Time:

Report Output Options: ☐ Browser ☐ Printer ☐ File

Analysis Requests

Battery Depth-Of-Discharge	99/145
Battery Depth-Of-Discharge	Tenpla
Battery Temperatures	99/145
Battery Temperatures	Tenpla
Battery Voltage Analysis	99/145
Battery Voltage Analysis	Tenpla

Routine Reports

Parameter Out-Of-Limits	99/145 11:2
Parameter Out-Of-Limits	99/207 13:5

Text 1 Top Margin:

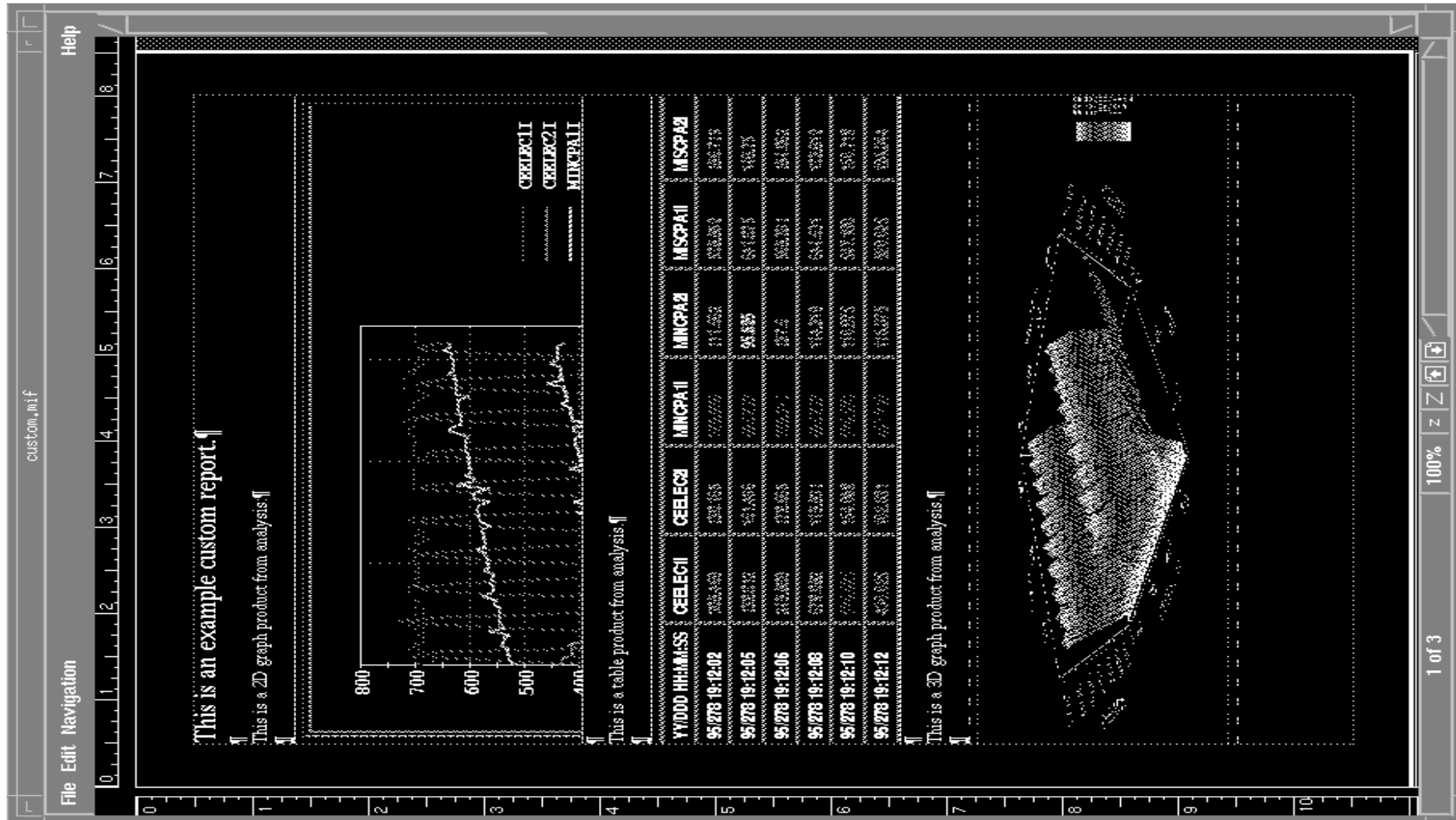
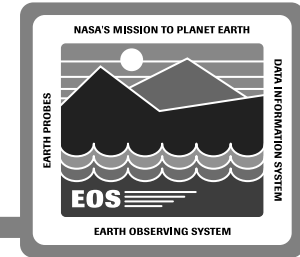
Report 1 Bottom Margin:

Graph 1 Left Margin:

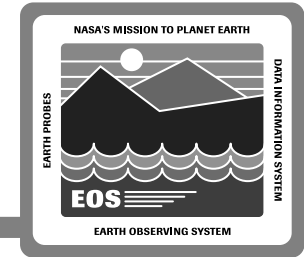
Graph 2 Right Margin:

Table 1 ☐ Landscape ☐ Portrait

Custom Report Example

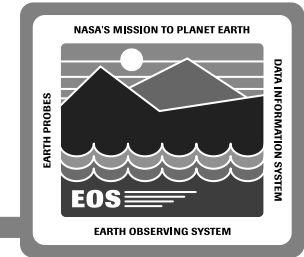


Weekly Reports



- The FOT uses the FUI provided *Custom Report* tool to:
 - Generate inputs automatically:
 - Trend and Performance Graphs
 - Tables
 - Periodic Reports
 - Define the contents and ordering of the report
- Summary / boiler plate info. is entered by individual subsystem engineers.
- Landsat 4/5 experience has shown that maintenance of the weekly status report archive is crucial to long term(5-8 yrs.) operations of an AM-1 class spacecraft.
- Electronic distribution of reports provided.

Analysis Algorithms



- The FOT develops algorithms to compute “values” and “metrics” in order to better manage their subsystems, as a natural course of evolution.
- Creation of algorithms for computing derived telemetry or Health and Safety tracking metrics is a common practice FOT.
- The Analysis Algorithms capability provides the infrastructure for:
 - Rapid development of AM-1 specific algorithms by the FOT.
 - Deployment of algorithms into a global execution space.
 - Refinement of algorithms over time.
 - Evolution of the baseline capabilities of the Analysis system over the life cycle of each EOS mission.